Environmental
Resources
Management

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ERM

January 18, 2013
Project No.: 0171815

Mr. Steven C. Riva
Chief, Permitting Section
Air Programs Branch
USEPA, Region 2
290 Broadway
New York, NY 10007-1866

Re: Response to comments from US EPA Region 2
PSD Non-applicability Support Document
Proposed Use of Alternative Fuels at EU-501
ESSROC San Juan Puerto Rico

Dear Mr. Riva:

This is in response to your letter dated December 11, 2012, regarding your prevention of significant deterioration (PSD) determination for the use of biomass as an alternative fuel at Essroc's cement kiln. The EPA determined the need of additional information in order to continue the evaluation of Essroc's Prevention of Significant Deterioration (PSD) non-applicability request. The information herein will provide the EPA with the additional information needed to conclude that the use of biomass as an alternative fuel at the Essroc facility will not trigger PSD program.

On behalf of Essroc, the following document was submitted by ERM to the EPA: *PSD Non Applicability Application: Use of Alternative Fuels in Cement Manufacturing, October 2012.* This document discussed the addition of alternative fuels to be co-processed or to substitute the use of coal in Essroc's kiln for the production of clinker. As stated in the document, the practice of using alternative fuels in cement kilns is well documented and promoted by the US EPA and the European Union.

The Essroc facility operates a dry-pre-heater/pre-calciner rotary kiln with a production capacity of 682,500 tons per year clinker using coal and used oil as a fuel[1]. The non PSD emission analysis established a baseline for the actual emissions (BAE) using the 572,048 tons/year of average production of the clinker for the 2-year period of 2005-2006 and

[1] The clinker production will be maintained at 682,550 ton/year using coal and used oil as a fuel as stated in the current permit.

estimated the projected actual emissions (PAE) at the maximum production capacity. Please note that we are updating our representative 2-year period to reflect 2004-2005 with an average clinker production rate of 579,763 tons per year. According to the EPA evaluation, the emission increase will trigger the applicability of the PSD program if the PAE is established at maximum production capacity. After reviewing the information provided to the EPA regarding the PAE, Essroc will establish the PAE at the same production capacity of clinker as the BAE at 579,763 tons/year. The production of clinker using biomass as an alternative fuel will be limited to 579,763 tons/year.

The estimates of BAE were based on the emission factors used by Essroc to determine the emissions limits for the kiln, and are the basis of the calculations included in the construction and Title V operating permit. The emission limits and the BAE are included in Table 1.

Table 1 ESSROC's current baseline emissions permitted average - Years: 2004 & 2005

Pollutant	Normalized Emission Limit (lb/ton clinker)	Clinker Production (tons/year)	Baseline Actual Emissions (ton/year)
Nitrogen Oxides (NOx)	4.2	579,763	1,217.51
Sulfur Dioxide (SO_2)	NA	**	323.92
Carbon Monoxide (CO)	3.7	579,763	1,072.56
Total Particulate Matter (PM)	0.34	579,763	104
Particulate Matter Less Than 10 Microns (PM_{10})	0.34	579,763	104
Lead (Pb)	7.58*10-5	579,763	0.02
Volatile Organic Compounds (VOC)	0.12	579,763	34.79

**75% absorption of sulfur into clinker (AP-42, Supplement 5, page 11.6-6)

With regard to the PAE, the emission factors used were developed by a similar source and were used by other cement operating facilities for their PSD application[2] for the State of Florida Department of Environmental Protection. The emission factors were developed by the Cemex Miami Cement Plant based on results of a complete and reported study while burning woody biomass. This study performed in 2010 resulted in a net decrease in SOx and NOx and increases in CO and VOC. The emission factors developed by the CEMEX stack tests and CEM data are included in Table 2. The percentage changes in emission rates are applied to the ESSROC baseline emission factors to estimate PAE.

Table 2 Cellulosic biomass emission factors based on testing conducted at Cemex, Miami Cement Plant

	Pollutant(lb/ton Clinker)				
	SO2*	NOx*	CO*	VOC*	PM
Cemex Baseline Emission Factor (EF)	0.041	2.704	542.139	0.06	-
Cemex Alternative Fuel Emission Factor (EF)	0.031	2.059	562.359	0.071	-
Observed Change in Emissions (%)	-24.39%	-23.85%	3.73%	18.33%	-

* Based on test data generated by Cemex Miami Plant from September to November 2010.

[2] AC Permit Application Installation of Equipment Necessary for the Preparation and Injection of Alternative Fuel Materials, Cemex Construction Materials Florida, LLC; Facility ID: 250014, December 2011

AC Permit Application: Modification of Calciner Duct work and Installation of Equipment Necessary for Preparation and Injection of Alternative Fuel, Swannee American Cement; Facility Id: 1210465

The emissions factors predicted for Essroc by using biomass are included in Table 3.

Table 3 Cellulosic biomass emission factors prediction for Essroc (woody biomass and AP42)

	Emission Factor (lb/Clinker)				
	SO2*	NOx	CO	VOC	PM**
Essroc San Juan Baseline EF		4.20	3.70	0.12	0.34
Essroc San Juan Predicted Alt.Fuel EF		3.20	3.84	0.14	0.34

*Biomass usually has lower sulfur content than coal so co-firing results in a reduction of SOx emissions because of a displacement of sulfur in the fuel blend[3]. The emission factor developed by Cemex Miami Plant for biomass demonstrated that the SO2 emissions were below the emission factor using coal. As a conservative approach for biomass, the SO2 emissions will be maintained at the same level as estimated using coal.

** Biomass releases approximately the same amount of particulate matter as coal. Therefore, as a conservative approach, we are using the same emission factor as coal to determine the emissions of PM.

The percent in change of emissions when firing biomass was used to determine the emission factors for PAE with a capacity production of 579,763 tons/year of clinker. The following table demonstrates that the emissions by using biomass will not trigger PSD applicability:

[3] National Renewable Energy Laboratory, A Summary of NOx Emissions Reduction from Biomass Co-firing (http://www.treepower.org/cofiring/main.html)

Table 4 Summary of comparison of existing and projected future emissions

100%	Maximum Fuel Substitution	Projected Production Rate (TPY Clinker)	Emission Factor (lb/ton Clinker)	Estimated Emissions (tons)	Difference in Emissions (tons)	PSD Threshold (tons)	PSD Applicability
SO2*	Biomass Coal	579,763	**	323.92 323.92	0.00	40.00	NO
NOx	Biomass Coal	579,763	3.18 4.2	921.8 1217.5	-295.68	40.00	NO
CO	Biomass Coal	579,763	3.84 3.70	1112.56 1072.56	40.00	100.00	NO
VOC	Biomass Coal	579,763	0.142 0.120	41.16 34.79	6.38	40.00	NO
PM	Biomass Coal	579,763	0.34 0.34	98.56 98.56	0.00	25.00	NO

* As a conservative approach, the SO2 emissions will be maintained at the same level as the level estimated using coal.

**75% absorption of sulfur into clinker (AP-42, Supplement 5, page 11.6-6)

Essroc will be conducting emissions tests to determine the emission factors for the use of the different types of biomass requested. The emissions tests will provide the necessary information to complement our determination that the estimated emissions from the use of biomass will not trigger the applicability of the PSD program.

If you have any questions, concerning the revised document, which supports the non-applicability of the PSD program or any other related issue, please call us at 787-622-0808.

Cordially,

Ángel O. Berríos Silvestre, P.E.
Engineer Consultant

Enclosure

Attachment I

OPERATING PARAMETERS

ESSROC OPERATING PARAMETERS YEARS 2002 to 2011

Year	2002	
Coal	80,688	ton/year
Clinker Production	520,147	ton/year
Year	2003	
Coal	77,588	ton/year
Used Oil	1,194,541	gal/year
Clinker Production	574,065	ton/year
Year	2004	
Coal	79,304	ton/year
Used Oil	736,255	gal/year
Clinker Production	578,092	ton/year
Year	2005	
Coal	80,381	ton/year
Used Oil	1,599,327	gal/year
Clinker Production	581,434	ton/year
Year	2006	
Coal	81,963	ton/year
Used Oil	10,933	gal/year
Clinker Production	562,663	ton/year
Year	2007	
Coal	59,956	ton/year
Used Oil	3,734	gal/year
Clinker Production	409,325	ton/year
Year	2008	
Coal	56,967	ton/year
Used Oil	33	gal/year
Clinker Production	362,846	ton/year
Year	2009	
Coal	46,218	ton/year
Used Oil	39	gal/year
Clinker Production	311,546	ton/year

Year	2010	
Coal	40,208	ton/year
Used Oil	39	gal/year
Clinker Production	255,288	ton/year

Year	2011	
Coal	40,208	ton/year
Used Oil	39	gal/year
Clinker Production	255,288	ton/year

ESSROC's Actual Emissions Years: 2002 to 2011

Year	Clinker Production (ton/year)	Pollutant Actual Emissions (tons/Year)						
		TSP	PM10	SOx	NOx	VOC	CO	Pb
2002	520,147	93.22	93.22	306.82	1,092.31	31.21	962.27	0.02
2003	574,065	102.88	102.88	297.29	1,205.54	34.44	1,062.02	0.02
2004	578,092	103.61	103.61	299.74	1213.99	34.69	1069.47	0.02
2005	581,434	104.22	104.22	348.09	1,221.01	34.89	1,075.65	0.02
2006	562,663	100.85	100.85	340.35	1,181.59	33.76	1,040.93	0.02
2007	409,325	73.37	73.37	248.89	859.58	24.56	757.25	0.02
2008	362,846	65.04	65.04	236.48	761.98	21.77	671.27	0.01
2009	311,546	55.84	55.84	191.80	654.25	18.69	576.36	0.01
2010	255,288	45.76	45.76	166.86	536.10	15.32	472.28	0.01
2011	255,288	45.76	45.76	166.86	536.10	15.32	472.28	0.01
Average 2005 & 2006:	579763	104	104	323.92	1217.50	34.79	1072.56	0.02

Attachment II

EMISSION FACTOR INFORMATION FROM OTHER CEMENT PLANTS

Original

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RESOURCE MANAGEMENT

Christy

Module: AB032

0250014-045-AC

EQUIPMENT FOR PREPARATION AND INJECTION OF ALTERNATIVE FUEL MATERIALS

CEMEX Construction Materials Florida, LLC
Miami, Miami-Dade County, Florida

Hardcopy Submitted: December 21, 2011

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263-11-13

Estimated Emissions

Estimated emissions are addressed in the following sections for each category of fuel material. Baseline emissions are calculated in detail for the baseline fuel, which is coal, using the hierarchy of data per 62-210.370, F.A.C. The coal emission factors for NO_x, SO_2 and THC (as VOC) are based on facility CEMs data. Emission factors for PM and CO are based on yearly stack tests. The summary indicates that estimated emissions for any or all fuels should not exceed the values of PSD applicability thresholds, assuming the maximum suggested fuel substitutions are followed.

Notwithstanding the calculation of estimated emissions, the following discussion is provided on current methods to control pollutant emissions applied at the CEMEX Miami Cement Plant.

Each fuel type and the PSD analysis of each fuel are provided below. As noted above, the PSD-specific analysis does not include mercury or lead. The analysis addresses NO_x, SO_2, CO, VOC, PM/PM10 and greenhouse gases.

PSD Analysis – Comparison to similar projects

Comprehensive data of European cement kilns show that firing of alternative fuels does not increase emissions of air pollutants. When reviewing the PSD analysis for other projects, a similar general trend of reduced emissions is seen. The following emissions summary data shows these general trends from cement plants in Europe burning alternative fuels in categories of 0, 0 to 10, 10 to 40, and above 40 percent heat replacement. [73]

See the following figures:

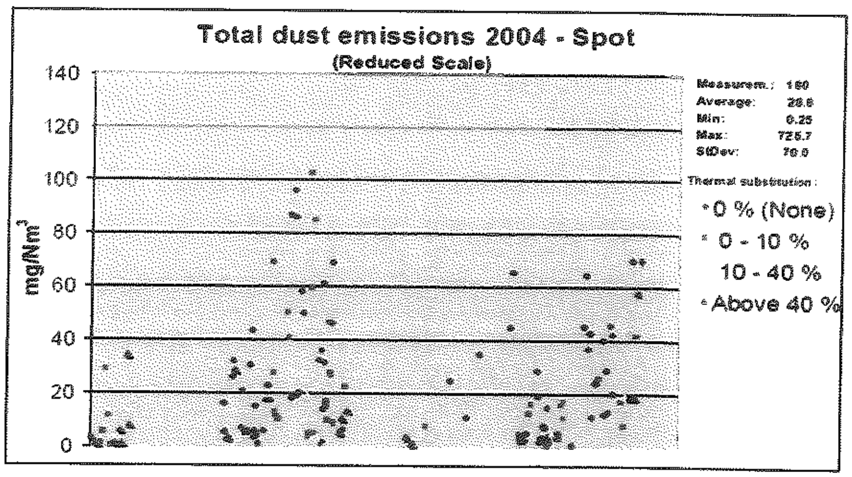

Figure 14. Particulate Matter emission values from 180 spot dust measurements in the clean gas of rotary kilns in the EU-27 and EU-23+ countries. [73]

[73] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, http://eippcb.jrc.ec.europa.eu

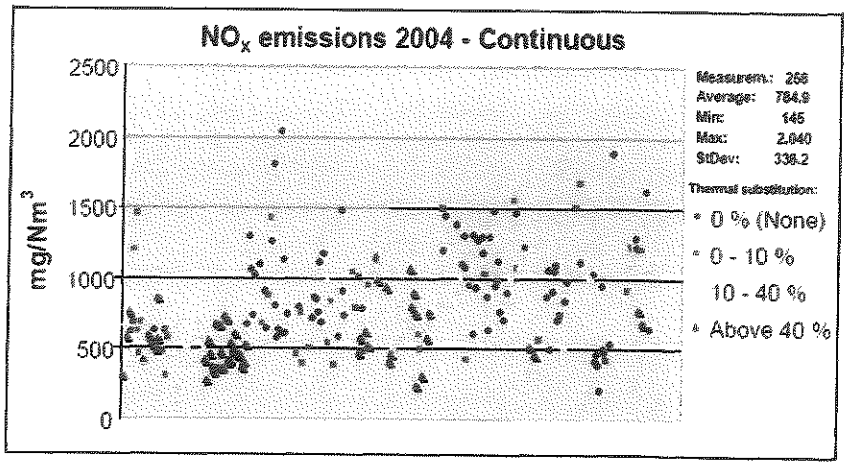

FIGURE 15. NOx EMISSIONS (EXPRESSED AS NO2) FROM CEMENT KILNS IN THE EU-27 AND EU-23+ COUNTRIES IN 2004 CATEGORIZED BY SUBSTITUTION RATE [73]

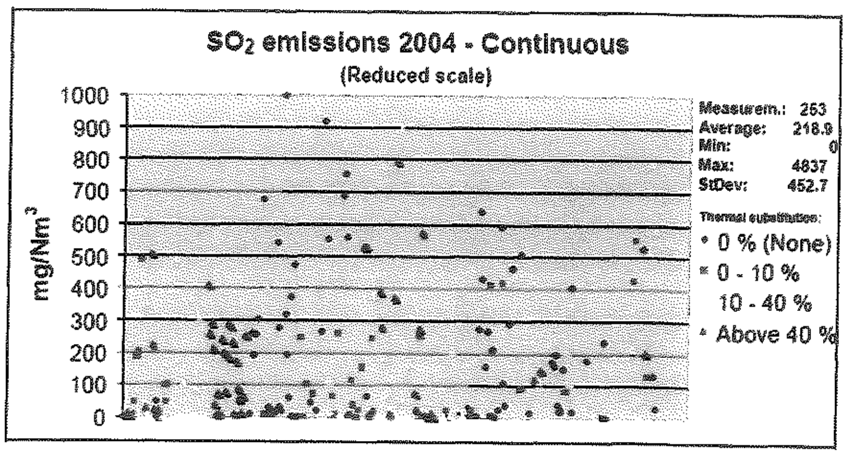

FIGURE 16. VALUES OF SO2 MEASUREMENTS IN THE CLEAN GAS FROM CEMENT PLANTS IN THE EU-27 AND EU-23+ COUNTRIES [73]

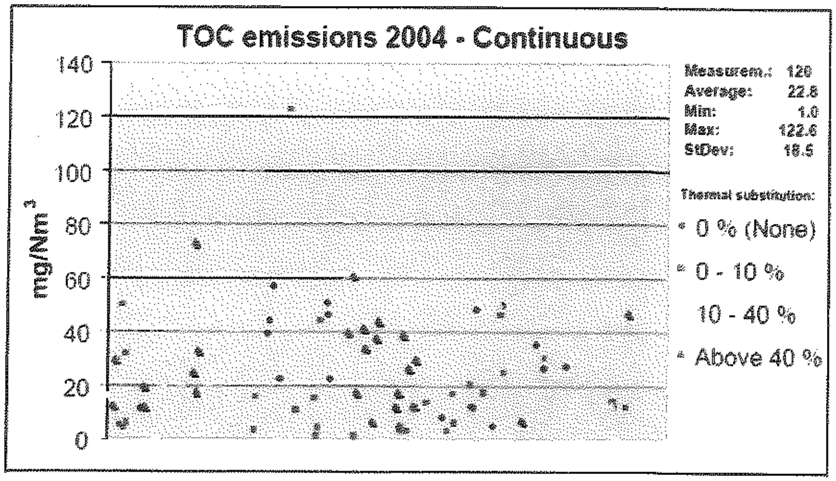

FIGURE 17. TOTAL ORGANIC COMPOUNDS (TOC) GAS EMISSION VALUES FROM CONTINUOUS MEASUREMENTS IN THE CLEAN GAS OF CEMENT KILNS IN THE EU-27 AND EU-23+ COUNTRIES . [73]

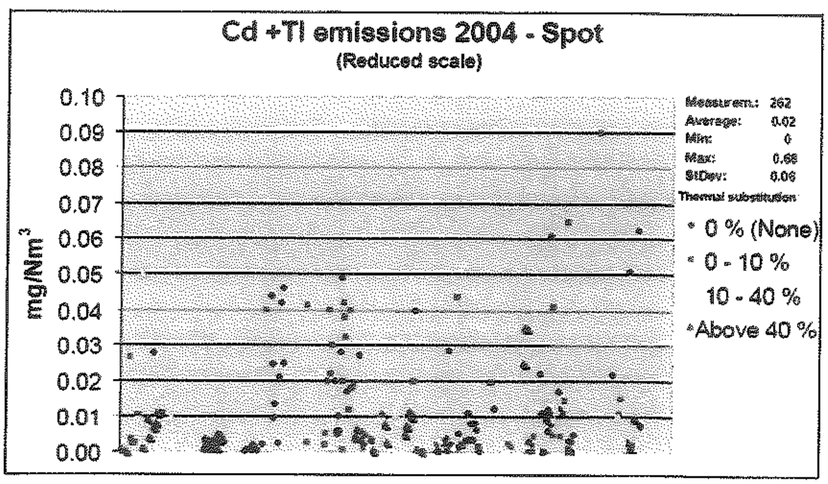

FIGURE 18. CADMIUM AND THALLIUM EMISSION VALUES FROM 262 SPOT (CD, TL) MEASUREMENTS IN THE EU-27 AND EU-23+ COUNTRIES. . [73]

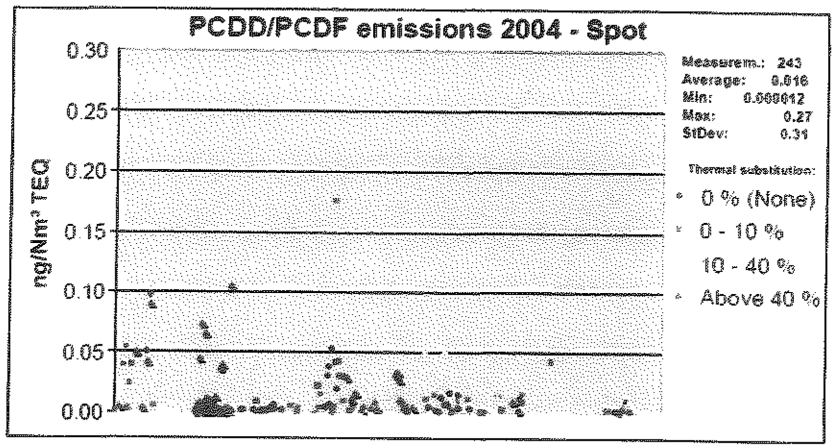

FIGURE 19. EMISSIONS OF PCDD/F IN THE EU-27 AND EU-23+ COUNTRIES IN 2004 CATEGORIZED BY THERMAL SUBSTITUTION RATE. [73]

BASELINE CALCULATIONS – TRADITIONAL FUELS

Emissions from traditional fuels were used as a baseline. This baseline comparison used plant data spanning the years of 2005 to 2010 and were applied for comparison to alternative fuel categories. Traditional fuels for fueling the kiln, as allowed in the Title V permit, are bituminous coal, natural gas, residual fuel oil, petroleum coke, propane, No. 2 fuel oil, flyash, on-specification and off-specification used oil, paper currency and whole tires. As such, a few of these traditional fuels have fueled the kiln for normal operations since operation began, simplifying the baseline data calculations. The following table shows baseline emissions from coal under normal operations.

TABLE 8. SUMMARY OF BASELINE EMISSIONS FOR COAL.

CEM Data

Nitrogen Oxides		
Average:	1102.36 ton/yr	0.941 lb/MMBtu
2010:	708.43 ton/yr	0.783 lb/MMBtu
2009:	819.30 ton/yr	0.783 lb/MMBtu
2008:	781.10 ton/yr	0.599 lb/MMBtu
2007:	1440.00 ton/yr	0.909 lb/MMBtu
2006:	1408.30 ton/yr	1.245 lb/MMBtu
2005:	1457.00 ton/yr	1.328 lb/MMBtu
Two Year Average:	(2006, 2005)	1.287 lb/MMBtu

Volatile Organic Compounds		
Average:	41.00 ton/yr	3.48E-02 lb/MMBtu
2010:	22.24 ton/yr	2.46E-02 lb/MMBtu
2009:	35.92 ton/yr	3.43E-02 lb/MMBtu
2008:	32.71 ton/yr	2.51E-02 lb/MMBtu
2007:	53.80 ton/yr	3.40E-02 lb/MMBtu
2006:	47.90 ton/yr	4.23E-02 lb/MMBtu
2005:	53.40 ton/yr	4.87E-02 lb/MMBtu
Two Year Average:	(2006, 2005)	4.55E-02 lb/MMBtu

Sulfur Dioxide		
Average:	11.50 ton/yr	9.61E-03 lb/MMBtu
2010:	8.41 ton/yr	9.29E-03 lb/MMBtu
2009:	13.93 ton/yr	1.33E-02 lb/MMBtu
2008:	9.87 ton/yr	7.57E-03 lb/MMBtu
2007:	20.10 ton/yr	1.27E-02 lb/MMBtu
2006:	14.40 ton/yr	1.27E-02 lb/MMBtu
2005:	2.30 ton/yr	2.10E-03 lb/MMBtu
Two Year Average:	(2007, 2006)	1.27E-02 lb/MMBtu

Stack Test Data

Particulate Matter[a]		
Average:	21.03 ton/yr	1.81E-02 lb/MMBtu
2010:	15.48 ton/yr	1.71E-02 lb/MMBtu
2009:	16.54 ton/yr	1.58E-02 lb/MMBtu
2008:	20.02 ton/yr	1.53E-02 lb/MMBtu
2007:	22.56 ton/yr	1.42E-02 lb/MMBtu
2006:	22.52 ton/yr	1.99E-02 lb/MMBtu
2005:	29.04 ton/yr	2.65E-02 lb/MMBtu
Two Year Average:	(2007, 2006)	1.71E-02 lb/MMBtu

Carbon Monoxide[a]		
Average:	697.39 ton/yr	0.61 lb/MMBtu
2010:	715.59 ton/yr	0.79 lb/MMBtu
2009:	658.41 ton/yr	0.63 lb/MMBtu
2008:	725.84 ton/yr	0.56 lb/MMBtu
2007:	659.92 ton/yr	0.42 lb/MMBtu
2006:	725.72 ton/yr	0.64 lb/MMBtu
2005:	698.85 ton/yr	0.64 lb/MMBtu
Two Year Average:	(2006, 2005)	0.64 lb/MMBtu

a. Based on a 5-year rolling average of stack test data.

TABLE 9. SUMMARY OF PRODUCTION AND FUEL USE BY YEAR

Operational Parameters

Year	2010
Coal[a]	60,841 ton/yr
Residual Oil[a]	1,056,803 gal/yr
Tires[a]	2814 ton/yr
Total Heat Input	1,810,382 MMBtu/yr
Preheater Feed	1,120,342 ton/yr
Clinker Production	722,801 ton/yr

Year	2009
Coal[a]	73,851 ton/yr
Residual Oil[a]	1,087,609 gal/yr
Tires[a]	533 ton/yr
Total Heat Input	2,093,863 MMBtu/yr
Preheater Feed	1,095,489 ton/yr
Clinker Production	706,767 ton/yr

Year	2008
Coal[a]	94,045 ton/yr
Residual Oil[a]	1,036,924 gal/yr
Tires[a]	445 ton/yr
Total Heat Input	2,609,168 MMBtu/yr
Preheater Feed	1,356,331 ton/yr
Clinker Production	875,052 ton/yr

Year	2007
Coal[a]	115,304 ton/yr
Residual Oil[a]	1,149,910 gal/yr
Tires[a]	0 ton/yr
Total Heat Input	3,166,941 MMBtu/yr
Preheater Feed[b]	1,637,612 ton/yr
Clinker Production	1,056,524 ton/yr

Year	2006
Coal[a]	81,116 ton/yr
Residual Oil[a]	1,043,480 gal/yr
Tires[a]	0 ton/yr
Total Heat Input	2,262,408 MMBtu/yr
Preheater Feed	1,612,640 ton/yr
Clinker Production	1,040,413 ton/yr

Year	2005
Coal[a]	79,024 ton/yr
Residual Oil[a]	946,800 gal/yr
Tires[a]	0 ton/yr
Total Heat Input	2,193,804 MMBtu/yr
Preheater Feed	1,621,447 ton/yr
Clinker Production	1,046,095 ton/yr

a. coal 26 mmbtu/ton, residual oil 0.147 mmbtu/gal, tires 26 mmbtu/ton

b. clinker factor of 1.55 assumed

Agricultural Biogenic Materials

Agricultural biogenic materials include organic materials from agricultural operations such as peanut hulls, rice hulls, corn husks, citrus peels, cotton gin byproducts, animal bedding, etc. These materials are typically of little value to farmers but have significant heat value and raw materials (e.g., silica, iron). The materials can provide significant heat content and other parameters acceptable for kiln firing.

PSD Analysis

While burning agricultural organic fibrous byproducts are currently permitted at the CEMEX Miami Cement Plant (0250014-044-AV), a PSD analysis was still carried out to provide reassurance that the PSD threshold would not be reached. The PSD analysis for agricultural byproducts is based on the results of a complete and reported study done at the Miami Cement Plant while burning woody biomass. This study, which was performed in 2010, saw a net decrease in NO_x and SO_2 and increases of CO and VOC. This study was a short term trial and had periods of startup/shutdown of the injection equipment that limited the amount of emissions data and the amount of time for the kiln operators to learn to use the equipment. The PM emission factor that was used was 0.025 lb/mmbtu[74]. The emission results from this study show that emissions were comparable to that of traditional fuels and none of the pollutants exceeded PSD threshold.

74 USDA Forest Service, U.S.EPA (Regions 1 and 8), Montana Department of Natural Resources, Washington Department of Ecology, North East States for Coordinated Air Use Management. "Information on Air Pollution Control Technology for Woody Biomass Boilers." March 2009.

TABLE 17. CALCULATION OF PROJECTED AGRICULTURAL BIOGENIC MATERIALS EMISSION FACTOR

Agricultural Biogenic Materials Emissions - Direct Comparison
Based on Testing Conducted at the CEMEX, Miami Cement Plant (Woody Biomass)

	Measured Stack Emission Factors (EF)				
	SO_2*	NO_x*	CO*	VOC*	PM
Cemex Baseline Emission Factor (EF) =	0.041 lb/ton C	2.704 lb/ton C	542.139 lb/ton C	0.060 lb/ton C	--
Cemex Alt. Fuel Emission Factor (EF) =	0.031 lb/ton C	2.059 lb/ton C	562.359 lb/ton C	0.071 lb/ton C	--
Observed Change in Emissions (%)	-24.10%	-23.85%	3.73%	18.55%	--
Miami Cement Plant Baseline EF	1.3E-2 lb/mmbtu	1.29 lb/mmbtu	0.6 lb/mmbtu	4.6E-2 lb/mmbtu	1.7E-2 lb/mmbtu
Miami Cement Plant Predicted Alt. Fuel EF	9.6E-3 lb/mmbtu	0.98 lb/mmbtu	0.7 lb/mmbtu	5.4E-2 lb/mmbtu	2.5E-2 lb/mmbtu**

**Based on Test period from September 2010 to November 2010*
***USDA Forest Service, U.S.EPA (Regions 1 and 8), Montana Department of Natural Resources, Washington Department of Ecology, North East* States for Coordinated Air Use Management. " Information on Air Pollution Control Technology for Woody Biomass Biolers." March 2009.

TABLE 18. ESTIMATED EMISSIONS FROM AGRICULTURAL BIOGENIC MATERIALS

Agricultural Biogenic Materials

Material Comparison:

	Coal (wet)	Material (wet)	
Moisture Content	5.98%	24.0%	percent
Heat Content	13,264	7,650	btu/lb
Heat Content	26.5	15.3	mmbtu/ton

Emissions Comparison:

100%	Maximum Fuel Substitution	Projected Heat Input (mmbtu)	Emission Factor (lb/mmbtu)	Estimated Emissions (tons)	Difference in Emissions (tons)
SO_2	Test Material[a]	2,356,094	9.65E-03	11.37	-3.61
	Coal Equivalent[b]		1.27E-02	14.98	
NO_x	Test Material[a]	2,356,094	9.80E-01	1154.14	-361.56
	Coal Equivalent[b]		1.29E+00	1515.70	
CO	Test Material[a]	2,356,094	6.63E-01	781.25	28.09
	Coal Equivalent[b]		6.39E-01	753.16	
VOC	Test Material[a]	2,356,094	5.40E-02	63.56	9.94
	Coal Equivalent[b]		4.55E-02	53.62	
PM	Test Material[d]	2,356,094	2.50E-02	29.45	9.33
	Coal Equivalent[b]		1.71E-02	20.12	
CO_2	Test Material[c]	2,356,094	2.54E+02	298685.57	44177.94
	Coal Equivalent[c]		2.16E+02	254507.63	
CH_4	Test Material[c]	2,356,094	7.10E-02	83.64	55.37
	Coal Equivalent[c]		2.40E-02	28.27	
N_2O	Test Material[c]	2,356,094	0.0042	4.95	0.82
	Coal Equivalent[c]		3.50E-03	4.12	

a. Based on Testing Conducted at the CEMEX, Miami Cement Plant (Woody Biomass)
b. EF: Based on CEM data, stack test data, and material usage (see Table 4)
c. Emission Factor (EF) based on data gathered from Tables C-1 and C-2 from 40 CFR 98
CO2 EF average of Agricultural ByProducts and Peat values
CH4 and N2O EF taken from Solid Biomass Fuels values
d. "Information on Air Pollution Control Technology for Woody Biomass Biolers." March 2009.

CALCINER MODIFICATION AND EQUIPMENT FOR PREPARATION AND INJECTION OF ALTERNATE FUEL MATERIAL

ORigina

Suwannee American Cement Company
Branford, Suwannee County, Florida

Hardcopy Submitted: December 6, 2011

KOOGLER & ASSOCIATES, INC.
ENVIRONMENTAL SERVICES
4014 NW 13th STREET
GAINESVILLE, FL 32609-1923
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624-11-11

Estimated Emissions

Estimated emissions are addressed in the following sections for each category of fuel material. Baseline emissions are calculated in detail for the baseline fuel, which is coal, using the hierarchy of data per 62-210.370, F.A.C. The coal emission factors for NO_x, SO_2, and THC (as VOC) are based on facility CEMs data. Emission factors for CO and PM are based on yearly stack tests. Mercury and lead emissions are based on material analysis. Note that the facility commenced full operation of the dry process kiln in March of 2003. Therefore, the emissions data for the 2003 baseline is based on a partial year. The summary indicates that estimated emissions for any or all fuels should not exceed the values of PSD applicability thresholds.

Notwithstanding the calculation of estimated emissions, the following discussion is provided on current methods to control pollutant emissions applied at the Branford Cement Plant.

In particular, mercury and lead emissions are briefly discussed in the PSD analysis in accordance with the more stringent permitted limit for mercury (97 lb/yr) and data coming from stack tested emissions of lead.

Each fuel type and the PSD analysis of each fuel are provided below. As noted above, the PSD-specific analysis does not include mercury or lead. The analysis addresses NO_x, SO_2, CO, VOC and PM/PM10.

PSD Analysis – Comparison to similar projects

Comprehensive data of European cement kilns show that firing of alternative fuels does not increase emissions of air pollutants.[5] Therefore, for PSD analysis in review of other projects is the general trend of similar or reduced emissions from comparable projects. The following example of emissions summary data shows these general trends.

See the following figures:

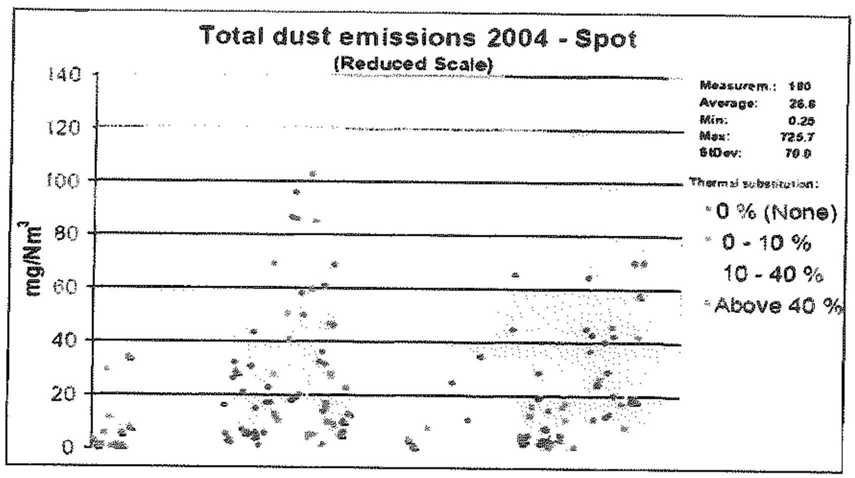

Figure 7. Dust emission values from 180 spot dust measurements in the clean gas of rotary kilns in the EU-27 and EU-23+ countries.

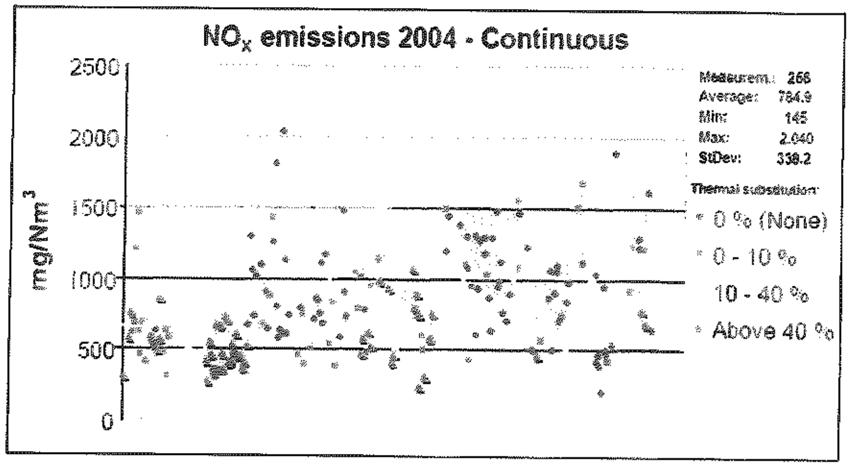

FIGURE 8. NOX EMISSIONS (EXPRESSED AS NO2) FROM CEMENT KILNS IN THE EU-27 AND EU-23+ COUNTRIES IN 2004 CATEGORIZED BY SUBSTITUTION RATE

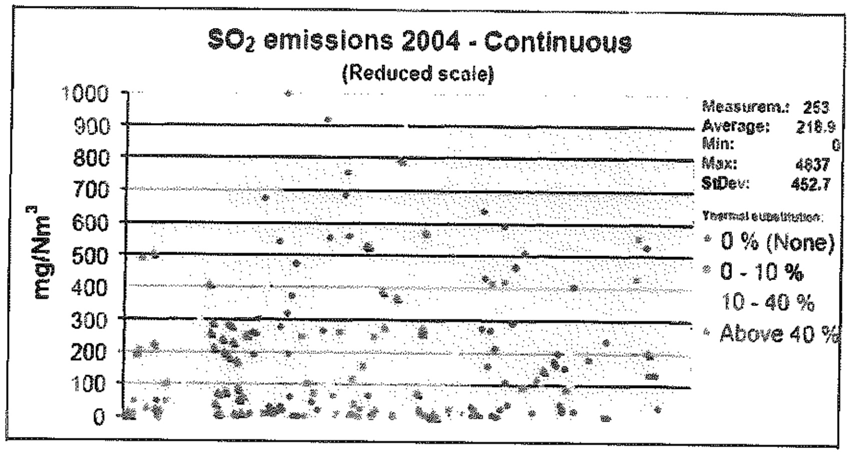

FIGURE 9. VALUES OF SO2 MEASUREMENTS IN THE CLEAN GAS FROM CEMENT PLANTS IN THE EU-27 AND EU-23+ COUNTRIES

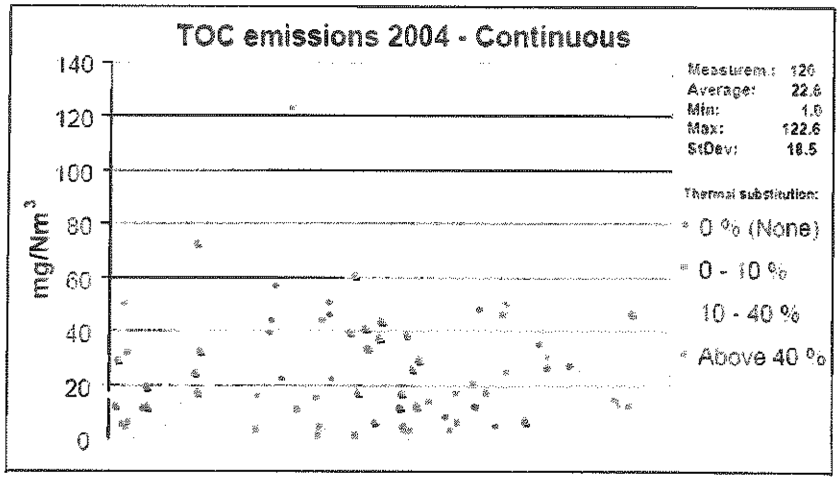

FIGURE 10. TOC EMISSION VALUES FROM CONTINUOUS MEASUREMENTS IN THE CLEAN GAS OF CEMENT KILNS IN THE EU-27 AND EU-23+ COUNTRIES

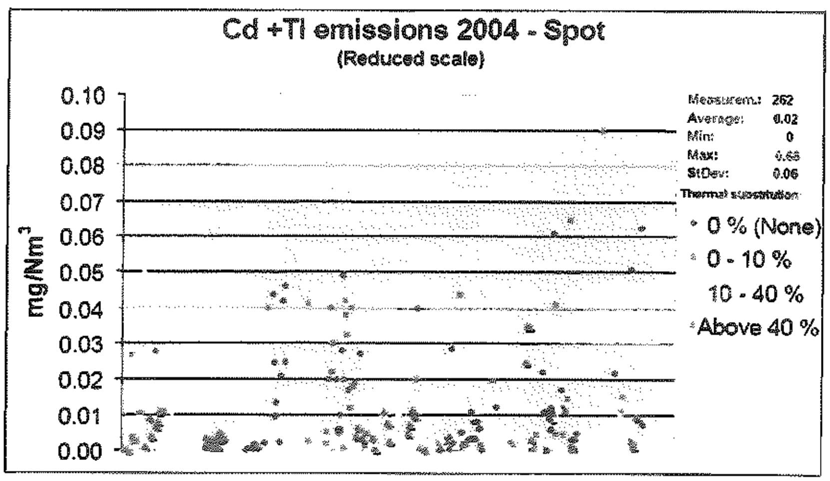

FIGURE 11. CADMIUM AND THALLIUM EMISSION VALUES FROM 262 SPOT (CD, TL) MEASUREMENTS IN THE EU-27 AND EU-23+ COUNTRIES

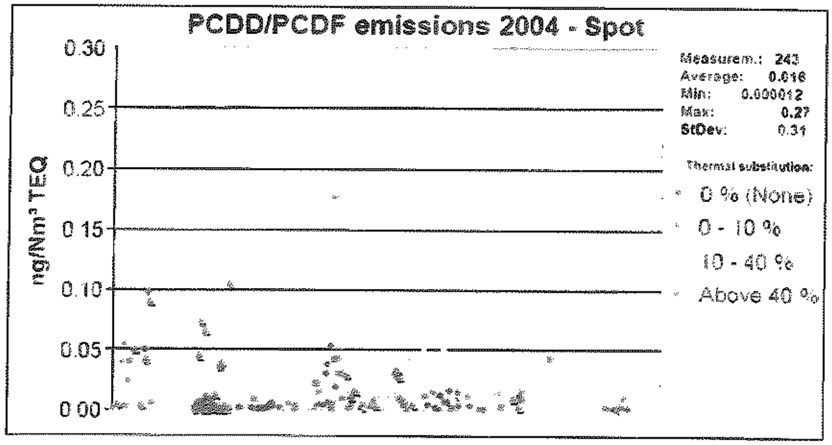

FIGURE 12. EMISSIONS OF PCDD/F IN THE EU-27 AND EU-23+ COUNTRIES IN 2004 CATEGORIZED BY THERMAL SUBSTITUTION RATE

BASELINE CALCULATIONS – TRADITIONAL FUELS

Representative data of emissions from traditional fuels used during the years from 2003 to 2010 are applied for comparison to alternative fuel categories. Traditional fuels for fueling the kiln, as allowed in the Title V permit, are coal, natural gas and pet coke. Traditional fuels have fueled the kiln for normal operations since operation began, simplifying the baseline data calculations. The following table shows baseline emissions from coal under normal operations. Note that the new kiln system was operational from mid-2003 onward.

TABLE 5. SUMMARY OF BASELINE EMISSIONS FOR COAL.

CEM Data

Nitrogen Oxides		
Average:	651.28 ton/yr	0.673 lb/MMBtu
2010:	469.41 ton/yr	0.677 lb/MMBtu
2009:	355.24 ton/yr	0.592 lb/MMBtu
2008:	674.10 ton/yr	0.678 lb/MMBtu
2007:	834.40 ton/yr	0.742 lb/MMBtu
2006:	848.60 ton/yr	0.743 lb/MMBtu
2005:	865.80 ton/yr	0.721 lb/MMBtu
2004:	866.40 ton/yr	0.653 lb/MMBtu
2003:	296.30 ton/yr	0.581 lb/MMBtu
Max Two Year Average:	(2007, 2006)	0.743 lb/MMBtu

Volatile Organic Compounds		
Average:	17.78 ton/yr	1.91E-02 lb/MMBtu
2010:	21.01 ton/yr	3.03E-02 lb/MMBtu
2009:	14.62 ton/yr	2.44E-02 lb/MMBtu
2008:	17.50 ton/yr	1.76E-02 lb/MMBtu
2007:	13.60 ton/yr	1.21E-02 lb/MMBtu
2006:	25.00 ton/yr	2.19E-02 lb/MMBtu
2005:	16.50 ton/yr	1.41E-02 lb/MMBtu
2004:	27.50 ton/yr	2.07E-02 lb/MMBtu
2003:	6.10 ton/yr	1.20E-02 lb/MMBtu
Max Two Year Average:	(2010, 2009)	2.73E-02 lb/MMBtu

Sulfur Dioxide		
Average:	8.04 ton/yr	9.08E-03 lb/MMBtu
2010:	2.38 ton/yr	3.43E-03 lb/MMBtu
2009:	5.46 ton/yr	9.10E-03 lb/MMBtu
2008:	7.60 ton/yr	7.65E-03 lb/MMBtu
2007:	7.80 ton/yr	6.94E-03 lb/MMBtu
2006:	14.20 ton/yr	1.24E-02 lb/MMBtu
2005:	13.90 ton/yr	1.16E-02 lb/MMBtu
2004:	3.30 ton/yr	2.49E-03 lb/MMBtu
2003:	9.70 ton/yr	1.90E-02 lb/MMBtu
Max Two Year Average:	(2009, 2003)	1.41E-02 lb/MMBtu

Stack Test Data

Particulate Matter		
Average:	11.27 ton/yr	1.28E-02 lb/MMBtu
2010:	15.28 ton/yr	2.20E-02 lb/MMBtu
2009:	15.86 ton/yr	2.64E-02 lb/MMBtu
2008:	16.34 ton/yr	1.64E-02 lb/MMBtu
2007:	13.70 ton/yr	1.22E-02 lb/MMBtu
2006:	14.17 ton/yr	1.24E-02 lb/MMBtu
2005:	7.96 ton/yr	6.61E-03 lb/MMBtu
2004:	5.81 ton/yr	4.37E-03 lb/MMBtu
2003:	1.06 ton/yr	2.08E-03 lb/MMBtu
Max Two Year Average:	(2010, 2009)	2.42E-02 lb/MMBtu

Carbon Monoxide		
Average:	609.44 ton/yr	0.68 lb/MMBtu
2010:	598.35 ton/yr	0.86 lb/MMBtu
2009:	691.92 ton/yr	1.15 lb/MMBtu
2008:	787.68 ton/yr	0.79 lb/MMBtu
2007:	701.14 ton/yr	0.62 lb/MMBtu
2006:	660.86 ton/yr	0.58 lb/MMBtu
2005:	661.62 ton/yr	0.55 lb/MMBtu
2004:	543.56 ton/yr	0.41 lb/MMBtu
2003:	230.39 ton/yr	0.45 lb/MMBtu
Max Two Year Average:	(2010, 2009)	1.01 lb/MMBtu

TABLE 6. SUMMARY OF PRODUCTION AND FUEL USE BY YEAR

Operational Parameters

Year	2010
Coal[a]	52,939 ton/yr
Natural Gas[a]	5.39 million cf/yr
Coke[a]	0 ton/yr
Solid Waste[a]	441 ton/yr
Total Heat Input	1,386,040 MMBtu/yr
Preheater Feed	683,403 ton/yr
Clinker Production	441,701 ton/yr

Year	2009
Coal[a]	45,892 ton/yr
Natural Gas[a]	6.77 million cf/yr
Coke[a]	0 ton/yr
Solid Waste[a]	0 ton/yr
Total Heat Input	1,200,301 MMBtu/yr
Preheater Feed	597,243 ton/yr
Clinker Production	385,277 ton/yr

Year	2008
Coal[a]	76,214 ton/yr
Natural Gas[a]	6.02 million cf/yr
Coke[a]	0 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	1,987,886 MMBtu/yr
Preheater Feed	1,055,606 ton/yr
Clinker Production	675,214 ton/yr

Year	2007
Coal[a]	85,875 ton/yr
Natural Gas[a]	8.11 million cf/yr
Coke[a]	244 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	2,247,756 MMBtu/yr
Preheater Feed[b]	1,310,355 ton/yr
Clinker Production	845,390 ton/yr

Year	2006
Coal[a]	86,933 ton/yr
Natural Gas[a]	22.00 million cf/yr
Coke[a]	28 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	2,284,103 MMBtu/yr
Preheater Feed	1,312,044 ton/yr
Clinker Production	844,314 ton/yr

Year	2005
Coal[a]	91,443 ton/yr
Natural Gas[a]	24.00 million cf/yr
Coke[a]	0 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	2,402,718 MMBtu/yr
Preheater Feed	1,226,119 ton/yr
Clinker Production	790,968 ton/yr

Year	2004
Coal[a]	99,344 ton/yr
Natural Gas[a]	714,895 therms/yr
Coke[a]	0 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	2,654,434 MMBtu/yr
Preheater Feed[b]	1,173,593 ton/yr
Clinker Production	757,157 ton/yr

Year	2003
Coal[a]	37,539 ton/yr
Natural Gas[a]	433,159 therms/yr
Coke[a]	0 ton/yr
Solid Waste	0 ton/yr
Total Heat Input	1,019,330 MMBtu/yr
Preheater Feed[b]	303,143 ton/yr
Clinker Production	195,576 ton/yr

a. coal 26 mmbtu/ton, natural gas 1050 mmbtu/mscf, coke 26.6 mmbtu/ton, solid Waste 9 mmbtu/ton

b. clinker factor of 1.55 assumed

**2009, 2008, 2007, 2006, 2005, fuel consumption and clinker production retrieved from AOR, 2004, 2003 clinker factor retrieved from AOR, fuel consumption retrieved from EPI Data

Agricultural Biogenic Materials

Agricultural biogenic materials include organic materials from agricultural operations such as peanut hulls, rice hulls, corn husks, citrus peels, cotton gin byproducts, animal bedding, etc. These materials are typically of little value to farmers. The materials can provide significant heat content and other parameters acceptable for kiln firing.

PSD Analysis

The PSD analysis for agricultural byproducts is based on the results of a complete and reported study done at CEMEX's Miami Cement Plant in Miami, FL while burning woody biomass. This study, which was performed in 2010, saw a net decrease in NO_x and SO_2 and increases of CO and VOC. This study was a short term trial and had periods of startup/shutdown of the injection equipment that limited the amount of emissions data and the amount of time for the kiln operators to learn to use the equipment. The PM emission factors were determined by using Table 1.6-1 from AP42. The emission results from this study show that emissions were comparable to that of traditional fuels and none of the pollutants exceeded PSD threshold.

TABLE 14. CALCULATION OF PROJECTED AGRICULTURAL BIOGENIC MATERIALS EMISSION FACTOR

Agricultural Biogenic Materials Emissions - Direct Comparison

Based on Testing Conducted at the CEMEX, Miami Cement Plant (Woody Biomass) and AP-42

	Measured Stack Emission Factors (EF)				
	SO_2*	NO_x*	CO*	VOC*	PM
Cemex Baseline Emission Factor (EF) =	0.041 lb/ton C	2.704 lb/ton C	542.139 lb/ton C	0.060 lb/ton C	--
Cemex Alt. Fuel Emission Factor (EF) =	0.031 lb/ton C	2.059 lb/ton C	562.359 lb/ton C	0.071 lb/ton C	--
Observed Change in Emissions (%)	-24.10%	-23.85%	3.73%	18.55%	--
SAC Baseline EF	1.4E-2 lb/mmbtu	0.74 lb/mmbtu	1.0 lb/mmbtu	2.7E-2 lb/mmbtu	2.4E-2 lb/mmbtu
SAC Predicted Alt. Fuel EF	1.1E-2 lb/mmbtu	0.57 lb/mmbtu	1.0 lb/mmbtu	3.2E-2 lb/mmbtu	2.5E-2 lb/mmbtu**

**Based on Test period from September 2010 to November 2010*

***Based on Table 1.6-1 from AP42*

TABLE 15. ESTIMATED EMISSIONS FROM AGRICULTURAL BIOGENIC MATERIALS

Agricultural Biogenic Materials

Material Comparison:

	Coal (wet)	Material (wet)	
Moisture Content	5.98%	24.0%	percent
Heat Content	13,264	7,650	btu/lb
Heat Content	26.5	15.3	mmbtu/ton

Emissions Comparison:

100%	Maximum Fuel Substitution	Projected Heat Input (mmbtu)	Emission Factor (lb/mmbtu)	Estimated Emissions (tons)	Difference in Emissions (tons)
SO_2	Test Material[a]	1,897,821	1.07E-02	10.13	-3.22
	Coal Equivalent[b]		1.41E-02	13.35	
NO_x	Test Material[a]	---	---	---	< PSD Threshold[e]
	Coal Equivalent[b]				
CO	Test Material[a]	---	---	---	< PSD Threshold[e]
	Coal Equivalent[b]				
VOC	Test Material[a]	1,897,821	3.24E-02	30.76	4.81
	Coal Equivalent[b]		2.73E-02	25.94	
PM	Test Material[d]	1,897,821	2.50E-02	23.72	0.72
	Coal Equivalent[b]		2.42E-02	23.00	
CO_2	Test Material[c]	1,897,821	2.54E+02	240589.60	35585.09
	Coal Equivalent[c]		2.16E+02	205004.51	
CH_4	Test Material[c]	1,897,821	7.10E-02	67.37	44.60
	Coal Equivalent[c]		2.40E-02	22.77	
N_2O	Test Material[c]	948,910	0.0042	1.99	0.33
	Coal Equivalent[c]		3.50E-03	1.66	

a. Based on Testing Conducted at the CEMEX, Miami Cement Plant (Woody Biomass) and AP-42
b. EF: Based on CEM data, stack test data, and material usage (see Table 4)
c. Emission Factor (EF) based on data gathered from Tables C-1 and C-2 from 40 CFR 98
   CO2 EF average of Agricultural ByProducts and Peat values
   CH4 and N2O EF taken from Solid Biomass Fuels values
d. **Based on Table 1.6-1 from AP42
e. Independent of fuel and controlled by plant operator and ammonia injection